Olivia Harper Wilkins

Fourth Year Committee Meeting: Wednesday 15 July 2020, 13:00

# Thesis outline

*\*Titles are placeholders*

**Chapter 1: Introduction**

* Astrochemistry as a field and key problems
* Schematic of star formation
* Emergence of chemical complexity alongside star formation
* Broader implications of astrochemistry research
  + How chemistry is used (probe, mechanisms, etc.)
  + Relationship to (astro)biology, solar system’s heritage
* Outline for thesis

Status: Not started

**Chapter 2: Methanol as a probe of physical and chemical conditions in Orion KL at high spatial resolution**

This chapter will describe ALMA observations at high spatial resolution toward Orion KL. Previously, methanol has been used to probe the structure of Orion KL at low spatial resolution. This work provides greater detail into the physical profile of Orion, which is important for understanding the chemical environments in this region. It also looks at possible ways in which methanol is desorbed off icy grains, providing a look at the connection between ice and gas chemistry.

Status: Manuscript in the works; most data analysis complete, but some additional analyses are being done

**Chapter 3: Deuterated methanol in Orion KL at high spatial resolution**

This chapter will describe ALMA observations at high spatial resolution toward Orion KL, specifically of singly-deuterated methanol. Deuterium chemistry can be used as a probe of cold formation, and in the case of methanol, deuterium can differentiate between methyl and hydroxyl carbons.

Status: Script written (to be adapted from Chapter 2 material)

**Chapter 4: The Previously Unexplored GMC (PUG) survey: Pilot 1.2 mm continuum results**

This chapter will detail the pilot results of an ALMA survey toward 11 previously unexplored giant molecular clouds (GMCs). The goal of this work is to find additional sites of high-mass star formation, as well as intermediate-mass star formation, to expand our sample for studying chemistry in such regions.

Status: Manuscript almost complete

**Chapter 5: The Previously Unexplored GMC (PUG) survey: Pilot chemistry results**

This work comes from the same observations as Chapter 3 but emphasizes the chemistry in these objects. Trends in the chemistry observed and their implications will be discussed. Planned follow-up observations will also be discussed in the context of what we can learn from different types of chemistry in high-mass regions.

Status: Data collected; preliminary analysis complete

**Chapter 6: The Previously Unexplored GMC (PUG) survey: A radio view**

This work will use the VLA to characterize PUG survey objects through methanol masers – a tracer of high-mass protostars – and ionized hydrogen (HII) regions – another signpost of star formation.

Status: Observations complete for nine out of eleven targets; data reduction underway

**Chapter 7: Summary**

This chapter will summarize the key findings of the thesis work and the gaps still remaining.

Status: Not started

**Appendix topics**:

* Code for Orion project – describe the code and how it works, put code on GitHub
* Appendices from stapled in manuscripts for PUG survey
* Posterior isotopic labeling of methyl formate with the GBT (observations complete but did not yield desired results)

# Tentative schedule

**Summer 2020**

* VLA observations, data calibration
* Wrap up Orion KL 13CH3OH project and submit manuscript
* Submit PUG survey manuscript
* Draft PUG survey chemistry manuscript

**Fall 2020**

* Analyze VLA data
* Draft GBT appendix
* Draft Chapter 2
* Draft Chapter 3
* Submit PUG survey chemistry manuscript
* Draft VLA manuscript and submit
* Outline props

**Winter 2021**

* Draft Chapter 4
* Draft Chapter 5
* Draft props

**Spring 2021**

* Draft/revise props
* Revise Chapters 2-5
* Write Chapter 1
* Write Chapter 6
* Complete appendix

**Summer 2021**

* Revise/edit thesis
* Props exam
* Defend thesis

# Questions

What types of things should go in the appendices, beyond what is planned above?  
Is this enough to go into the thesis?  
What absolutely needs to be done to graduate?

## Notes

* Touch base in the winter or spring
* Maybe push props exams up (perhaps to winter)
* Props should be *my* idea (basic scientific idea should be mine)
  + Can use prop from fellowship application